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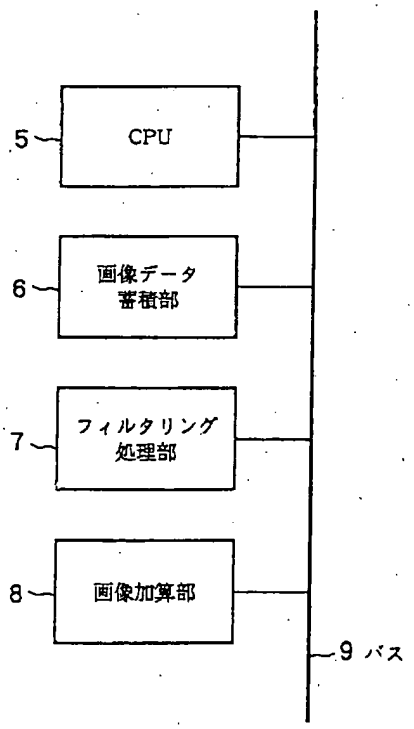
(54)【発明の名称】画像処理装置及びその方法

(57)【要約】
【課題】　ソフトフォーカス効果を得るためのデジタルフィルタ処理においては、１画素毎に畳み込み積分のためにフィルタサイズに応じた回数の加算処理が必要であり、処理時間が増大していた。
【解決手段】　画像データ蓄積部６に保持された原画像データに対し、フィルタリング処理部７において係数が全て１であるフィルタによるフィルタリング処理を行う。そして、画像加算部８において、前記原画像データと、フィルタリング後の画像データとを任意の割合で加算することにより、ソフトフォーカス効果が高速に得られる。



【特許請求の範囲】

【請求項１】　第１の画像データを入力する入力手段と、
前記第１の画像データに対して所定のフィルタを用いてフィルタリング処理を施し、第２の画像データを得るフィルタリング手段と、
前記第１の画像データと前記第２の画像データとを所定の割合で加算して第３の画像データを得る画像加算手段と、
前記第３の画像データを出力する出力手段と、
を有することを特徴とする画像処理装置。

【請求項２】　前記フィルタは８×８画素サイズであることを特徴とする請求項１記載の画像処理装置。

【請求項３】　前記フィルタは全ての係数が１であることを特徴とする請求項１記載の画像処理装置。

【請求項４】　前記画像加算手段における所定の割合は任意であることを特徴とする請求項１記載の画像処理装置。

【請求項５】　前記画像加算手段における所定の割合は、互いに０．５であることを特徴とする請求項１記載の画像処理装置。

【請求項６】　更に、前記第１乃至第３の画像データを表示可能な表示手段を有することを特徴とする請求項１記載の画像処理装置。

【請求項７】　第１の画像データを入力する入力工程と、
前記第１の画像データに対して所定のフィルタを用いてフィルタリング処理を施し、第２の画像データを得るフィルタリング工程と、
前記第１の画像データと前記第２の画像データとを所定の割合で加算して第３の画像データを得る画像加算工程と、
前記第３の画像データを出力する出力工程と、
を有することを特徴とする画像処理方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は画像処理装置及びその方法に関し、例えばデジタルフィルタ処理を行う画像処理装置及びその方法に関する。

【０００２】

【従来の技術】従来より、例えばソフトフォーカスフィルタ等の光学的フィルタを用いて画像を撮影することが普及している。

【０００３】まず、光学的ソフトフォーカスフィルタについて説明を行う。

【０００４】銀塩カメラまたはビデオカメラ等によって被写体を撮影する場合、撮影レンズの直前に、ある光学的特性をもった位相物体（透明な板状、レンズ状の物体）を置くことにより、撮影された画像に対する特殊効果を得るという手法がある。これを光学的フィルタ処理という。

【０００５】この光学的フィルタ処理を施すフィルタのひとつとして、ソフトフォーカスフィルタがある。図１に、ソフトフォーカスフィルタの構造を示す。図１に示す様に、ソフトフォーカスフィルタは透明版のランダムな位置に複数のローパス部（低周波だけを通過させるフィルタ）を配置した構造になっている。このようなソフトフォーカスフィルタを、撮影を行うカメラの撮影レンズ（結像レンズ）の直前に配置する。

【０００６】図２に、上述した様にソフトフォーカスフィルタを配した状態における、被写体、ソフトフォーカスフィルタ、結像レンズ、結像面の位置関係を示す。図２において、被写体からの光はフィルタを通過することにより、フィルタの光学的特性の影響を受ける。ここでフィルタにおいて、図１に示す透明板部を通過する光は高周波から低周波までを含む。一方、ローパス部は低周波のみを通過させ、更に、光を拡散させる。

【０００７】その結果、例えば人物の顔を撮影した場合について考えると、ある程度の高周波成分は残るが（顔の輪郭はある程度はっきりとしているので、焦点ずれによる画像とは異なる）、皮膚のしわ等の高周波成分はカットされ、なおかつ、全体的に光が回り込み、フレアがかかったようなソフトな画像を得ることができ、所謂ソフトフォーカス効果が得られる。

【０００８】このような光学フィルタ効果をデジタルの画像信号処理によって得る方法として、デジタルフィルタ処理が知られている。デジタルフィルタ処理については周知の技術であるため、ここでは具体的な説明を省略する。

【０００９】従来のデジタルフィルタ処理において、ソフトフォーカスの効果を得るためのフィルタ例を図３に示す。まずフィルタサイズとしては、処理対象の画像サイズにもよるが、例えば３０×３０の大きなものが使用される。またフィルタの各要素の重みづけに関しては、中心に大きな重みを持ち、広い範囲に小さな重みがあるという特徴を有している。

【００１０】デジタルの画像データに対してこのようなフィルタを用いてデジタルフィルタ処理を行うことにより、光学フィルタと同等のソフトフォーカス効果が得られる。

【００１１】

【発明が解決しようとする課題】しかしながら上記従来のデジタルフィルタ処理においては、以下の様な問題があった。例えば、上述した図３に示す３０×３０サイズのフィルタを例とすると、フィルタ処理を実行するためには該フィルタサイズに対応する画像毎に、畳み込み積分のために３０×３０＝９００回もの加算処理を行わなければならない。従って、膨大な処理時間を要してしまうという問題があった。そのため、該フィルタ処理を行う画像処理装置に対して高速処理が要求されていた。

【００１２】本発明は上述した課題を解決するためになされたものであり、ソフトフォーカス効果を得るデジタルフィルタ処理を高速に実行可能な画像処理装置及びその方法を提供することを目的とする。

【００１３】

【課題を解決するための手段】上述した目的を達成するための一手段として、本発明に係る画像処理装置は以下の構成を備える。

【００１４】即ち、第１の画像データを入力する入力手段と、前記第１の画像データに対して所定のフィルタを用いてフィルタリング処理を施し、第２の画像データを得るフィルタリング手段と、前記第１の画像データと前記第２の画像データとを所定の割合で加算して第３の画像データを得る画像加算手段と、前記第３の画像データを出力する出力手段とを有することを特徴とする。

【００１５】例えば、前記フィルタは８×８画素サイズであることを特徴とする。

【００１６】例えば、前記フィルタは全ての係数が１であることを特徴とする。

【００１７】例えば、前記画像加算手段における所定の割合は任意であることを特徴とする。

【００１８】例えば、前記画像加算手段における所定の割合は、互いに０．５であることを特徴とする。

【００１９】更に、前記第１乃至第３の画像データを表示可能な表示手段を有することを特徴とする。

【００２０】また、上述した目的を達成するための一手法として、本発明に係る画像処理方法は以下の工程を備える。

【００２１】即ち、第１の画像データを入力する入力工程と、前記第１の画像データに対して所定のフィルタを用いてフィルタリング処理を施し、第２の画像データを得るフィルタリング工程と、前記第１の画像データと前記第２の画像データとを所定の割合で加算して第３の画像データを得る画像加算工程と、前記第３の画像データを出力する出力工程とを有することを特徴とする。

【００２２】

【発明の実施の形態】以下、本発明に係る一実施形態について図面を参照して詳細に説明する。

【００２３】図４に、本実施形態における画像処理装置の概要構成を示す。図４において、１は画像入力部であり、処理対象となる画像データを入力する。例えば、外部のコンピュータから画像データを入力するインタフェース装置であっても良いし、ファクシミリ装置でも良い。本実施形態においては原稿画像を光学的に読み込むスキャナであるとする。２は画像処理部であり、画像入力部１から入力された画像に対してソフトフォーカス処理を行う。３は画像表示部であり、画像処理部２へ入力された画像や、処理を行った結果の画像等の表示を行う。４は画像出力部であり、画像処理部２で処理した結果の画像データを出力する。例えば、外部装置への出力インタフェース装置であっても良いし、ファクシミリ装置でも良い。本実施形態においては、処理後の画像データをハードコピーとして記録媒体上に形成して出力するプリンタであるとする。

【００２４】次に、画像処理部２の詳細構成を図５に示し、説明する。図５において、５はＣＰＵであり、画像処理部２内の制御をはじめ、図４で示した各構成の制御を行う。６は画像データ蓄積部であり、画像入力部１から読み込んだ画像データや処理途中である画像データ、及び処理結果である画像データ等を保持するためのメモリである。７はフィルタリング処理部であり、画像データ蓄積部６に保持された入力画像データに対してフィルタリング処理を行い、その結果を再度画像データ蓄積部６に書き込む。８は画像加算部であり、画像データ蓄積部６に保持されている画像データにおける画素同士を任意の割合で加算することができる。

【００２５】以下、以上の構成からなる本実施形態の画像処理装置におけるフィルタ処理について、図６のフローチャートを参照して説明する。図６は、画像処理部２におおいて行われるフィルタ処理のフローチャートである。

【００２６】●ステップＳ１

まず、ステップＳ１においては、画像入力部１により入力された画像データを、画像処理部２へ読み込む。本実施形態の画像入力部１は、例えばフラットヘッドタイプのスキャナである。原稿台に写真等の画像をセットして読取りを開始すると、ＣＰＵ５の制御により原稿の走査が行われ、画像データの読み込みが行われる。画像データは、画像処理部２において画像データ蓄積部６へ保存される。尚、本実施形態において扱う画像データは、ＲＧＢ各８ビットで構成されるカラー画像であるとする。また、入力された画像データは画像表示部３に表示されるため、操作者が入力の結果を目視で確認することができる。

【００２７】●ステップＳ２

次にステップＳ２においては、入力画像データに対してフィルタリング処理を行う。

【００２８】上述した従来例で説明したように、従来ソフトフォーカス処理には図３に示す様なフィルタを用いていた。これは３０×３０という大きなサイズのフィルタであるため、１画素あたりの畳み込み積分において３０×３０＝９００回もの加算処理が必要である。そのため、膨大な演算時間が必要であった。また、中心部分と周辺部分とで重み係数が異なるため、重み係数と画素値との乗算処理が必要となり、演算が複雑化していた。従って、重み係数が全て等しいフィルタに比べて演算時間が長くなってしまうという欠点があった。この二つの原因により、結果的に膨大な演算時間が必要であった。

【００２９】従って本実施形態においては、ソフトフォーカス処理を実現するフィルタを図７に示す様にした。

図７に示すフィルタにおいて、フィルタサイズは８×８、重みづけ係数は全て「１」である。このフィルタは、フィルタリング処理部７内に予め保持されている。

【００３０】本実施形態ではこのようなフィルタを用いることにより、１画素あたりの畳み込み積分において、８×８＝６４回の加算処理を行なえば良い。また、重み係数が全て「１」であるため、乗算を行う必要がない。この二つの要因により、本実施形態においては演算時間の大幅な短縮が可能となった。

【００３１】尚、フィルタリング処理結果は、画像データ蓄積部６へ格納される。

$$O(x, y) = aI(x, y) + bF(x, y) \quad \cdots (1)$$

ここで、ａ，ｂは　０＜＝ａ，ｂ＜＝１，ａ＋ｂ＝１である任意の定数である。

【００３５】この処理により、最終画像データＯ（ｘ，ｙ）においては、原画像の高周波成分がある程度残り、かつ低周波成分（輝度の変化の少ない部分）は滑らかになるという効果を得る。即ち、光学的ソフトフォーカス

$$O(x, y) = (I(x, y) + F(x, y)) / 2 \quad \cdots (2)$$

のような単純な演算で済み、更なる処理の高速化が実現できる。

【００３７】尚、加算処理の結果得られる画像データは、画像データ蓄積部６へ格納される。また、この画像データは画像表示部３に表示されるため、操作者がソフトフォーカス処理の結果を目視で確認することができる。

【００３８】●ステップＳ４

そしてステップＳ４において、ステップＳ３で得られた画像データを画像出力部４より出力する。画像出力部４は例えばカラーのインクジェットプリンタであり、ＣＰＵ５の制御によって画像の形成及び印刷が行われる。

【００３９】以上説明した処理により、本実施形態におけるソフトフォーカスフィルタ処理が実現される。

【００４０】以上説明した様に本実施形態によれば、比較的小さいサイズで、かつ係数が全て「１」であるフィルタによるフィルタリング処理を行なっても、その後、該フィルタリング後の画像データと原画像データとを任意の割合で加算することにより、ソフトフォーカス効果が得られる。従って、ソフトフォーカス効果を得るためのデジタルフィルタ処理を高速に実行することができる。

【００４１】＜他の実施形態＞上述した第１実施形態において、画像入力部１はフラットベッドタイプのスキャナとして説明を行ったが、もちろん画像入力部１はドラムスキャナ、あるいはＴＶカメラなどのエリアセンサを利用した画像入力装置によって構成しても良い。また、ハードディスク、フロッピーディスク、光磁気ディスク等の磁気媒体にあらかじめ記録してある画像を読み込むことによって入力を行なっても良い。

【００４２】また、第１実施形態においては、ＲＧＢ各８ビットで構成されるカラー画像データに対してフィルタ処理を行う例について説明したが、もちろんモノクロ画像に対しても同様の処理を行うことができる。

【００４３】また、第１実施形態においては、サイズが８×８で重みづけ係数が全て「１」であるフィルタを使用する例について説明したが、他のフィルタサイズや、重みづけ係数が全て「１」でなくても、同様の効果を得ることができる。

【００４４】なお、本発明は、複数の機器（例えばホストコンピュータ，インタフェイス機器，リーダ，プリンタなど）から構成されるシステムに適用しても、一つの機器からなる装置（例えば、複写機，ファクシミリ装置など）に適用してもよい。

【００４５】また、本発明の目的は、前述した実施形態の機能を実現するソフトウェアのプログラムコードを記録した記憶媒体を、システムあるいは装置に供給し、そのシステムあるいは装置のコンピュータ（またはＣＰＵやＭＰＵ）が記憶媒体に格納されたプログラムコードを読出し実行することによっても、達成されることは言うまでもない。

【００４６】この場合、記憶媒体から読出されたプログラムコード自体が前述した実施形態の機能を実現することになり、そのプログラムコードを記憶した記憶媒体は本発明を構成することになる。

【００４７】プログラムコードを供給するための記憶媒体としては、例えば、フロッピディスク，ハードディスク，光ディスク，光磁気ディスク，ＣＤ－ＲＯＭ，ＣＤ－Ｒ，磁気テープ，不揮発性のメモリカード，ＲＯＭなどを用いることができる。

【００４８】また、コンピュータが読出したプログラムコードを実行することにより、前述した実施形態の機能

【００３２】　ステップＳ３

ステップＳ３においては、画像データの加算処理を行う。具体的には、原画像データと、ステップＳ２で得られたフィルタ処理済みの画像データとを任意の割合で加算する。

【００３３】ここで、原画像データにおける各画素をＩ（ｘ，ｙ）、フィルタリング処理済みの画像データにおける各画素をＦ（ｘ，ｙ）とし、最終的に出力される画像データにおける各画素をＯ（ｘ，ｙ）とする。すると、Ｏ（ｘ，ｙ）は以下の式で表される。

【００３４】

フィルタを用いて撮影した画像と同等の結果を得ることができる。

【００３６】尚、本実施形態においては、ａ＝ｂ＝０．５を採用している。このため、実際の（１）式の演算は、

が実現されるだけでなく、そのプログラムコードの指示に基づき、コンピュータ上で稼働しているＯＳ（オペレーティングシステム）などが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【００４９】さらに、記憶媒体から読出されたプログラムコードが、コンピュータに挿入された機能拡張ボードやコンピュータに接続された機能拡張ユニットに備わるメモリに書込まれた後、そのプログラムコードの指示に基づき、その機能拡張ボードや機能拡張ユニットに備わるＣＰＵなどが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【００５０】

【発明の効果】以上説明した様に本発明によれば、比較的小さいサイズで、かつ係数が全て「１」であるフィルタによるフィルタリング処理を行なっても、その後、該フィルタリング後の画像データと原画像データとを任意の割合で加算することにより、ソフトフォーカス効果が得られる。従って、ソフトフォーカス効果を得るためのデジタルフィルタ処理を高速に実行することができる。

【００５１】

【図面の簡単な説明】

【図１】従来の光学的ソフトフォーカスフィルタの構造を示す図である。

【図２】従来のソフトフォーカスフィルタを使用する光学系である。

【図３】従来例のデジタルフィルタ例を示す図である。

【図４】本発明に係る一実施形態の画像処理装置の概要構成を示すブロック図である

【図５】本実施形態における画像処理部の詳細構成を示すブロック図である。

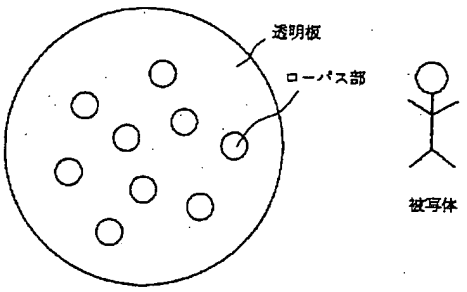
【図６】本実施形態におけるデジタルフィルタ処理を示すフローチャートである。

【図７】本実施形態で使用するデジタルフィルタ例を示す図である。

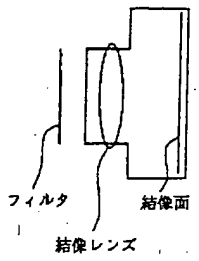
【符号の説明】

1　画像入力部
2　画像処理部
3　画像表示部
4　画像出力部
5　ＣＰＵ
6　画像データ蓄積部
7　フィルタリング処理部
8　画像加算部
9　バス

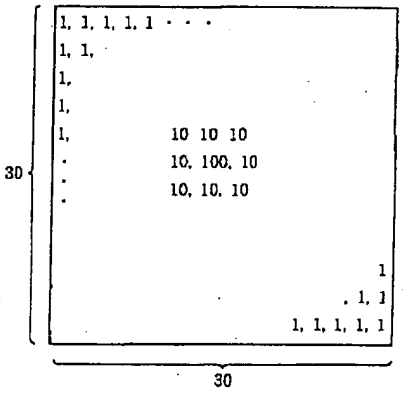
【図１】



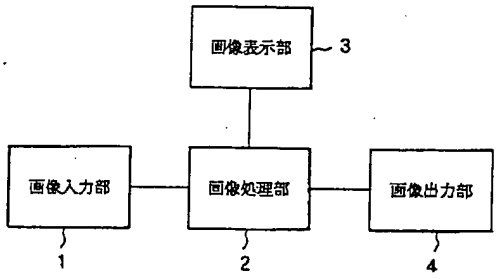
【図２】



【図３】



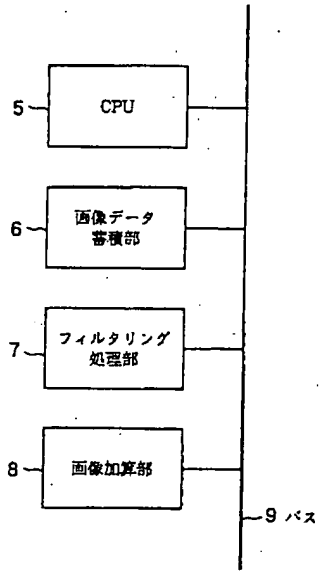
【図４】



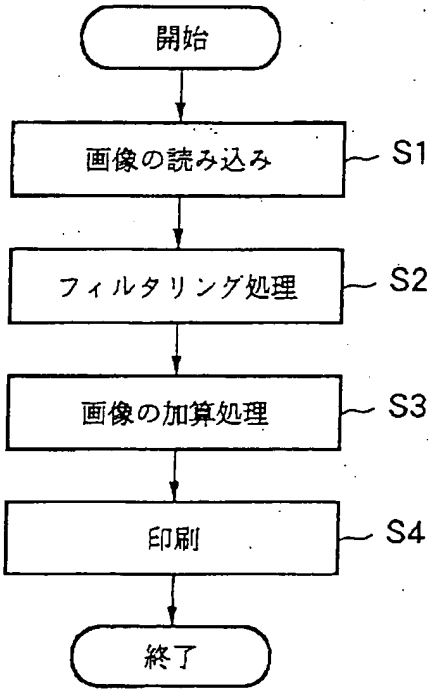
【図７】

1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1

【図５】


5
CPU
6
画像データ
蓄積部
7
フィルタリング
処理部
8
画像加算部
9 バス

【図６】


開始
画像の読み込み
S1
フィルタリング処理
S2
画像の加算処理
S3
印刷
S4
終了

PATENT ABSTRACTS OF JAPAN

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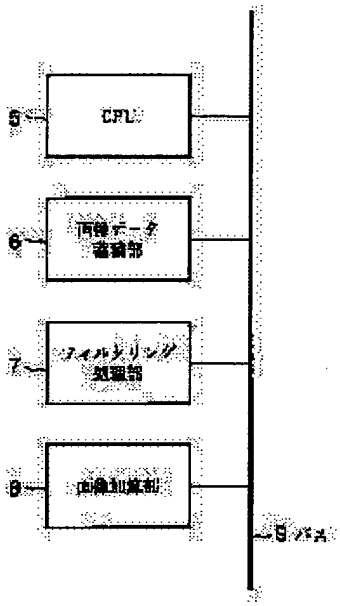
(22)Date of filing : 18.03.1996

(71)Applicant : CANON INC
(72)Inventor : YAMADA SHIGEKI

(54) IMAGE PROCESSOR AND METHOD THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To execute a digital filter processing for obtaining a soft-focus effect at high speed.
SOLUTION: The filtering processing is applied to original image date held in an image shorage part 6 by a filter whose all coefficients are one in a filtering processing part 7. Then, the original image data is added to picture data after filtering by an optional ratio in an image adding part 8, so that the soft-focus effect is obtained at high speed.



LEGAL STATUS

[Date of request for examination]

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] The image processing system characterized by to have a picture addition means add an input means to input the 1st image data, a filtering means to perform filtering processing using a predetermined filter to the 1st image data of the above, and to obtain the 2nd image data, and the 1st image data of the above and the 2nd image data of the above, at a predetermined rate, and obtain the 3rd image data, and an output means output the 3rd image data of the above.
[Claim 2] The aforementioned filter is an image processing system according to claim 1 characterized by being 8x8-pixel size.
[Claim 3] The aforementioned filter is an image processing system according to claim 1 characterized by all coefficients being 1.
[Claim 4] The predetermined rate in the aforementioned picture addition means is an image processing system according to claim 1 characterized by arbitrary things.
[Claim 5] The predetermined rate in the aforementioned picture addition means is an image processing system according to claim 1 characterized by being 0.5 mutually.
[Claim 6] Furthermore, the image processing system according to claim 1 characterized by having the display means which can display the above 1st or the 3rd image data.
[Claim 7] The image-processing method characterized by to have the picture addition process of adding the input process which inputs the 1st image data, the filtering process which performs filtering processing using a predetermined filter to the 1st image data of the above, and obtains the 2nd image data, and the 1st image data of the above and the 2nd image data of the above at a predetermined rate, and obtaining the 3rd image data, and the output process which outputs the 3rd image data of the above.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the image processing system which performs digital filter processing, and its method, concerning an image processing system and its method.
[0002]
[Description of the Prior Art] Conventionally, photoing a picture using optical filters, such as for example, a soft focus filter, has spread.
[0003] First, an optical soft focus filter is explained.
[0004] When photoing a photographic subject with a silver salt camera or a video camera, there is technique of obtaining the special effect to the photoed picture by placing the phase body (body of the shape of a transparent tabular and a lens) which had a certain optical property just before the taking lens. This is called optical filtering.
[0005] There is a soft focus filter as one of the filters which performs this optical filtering. The structure of a soft focus filter is shown in drawing 1 . As shown in drawing 1 , the soft focus filter has structure which has arranged two or more low-pass sections (filter which passes only low frequency) in the random position of the transparent version. Such a soft focus filter is arranged just before the taking lens (image formation lens) of the camera which takes a photograph.
[0006] The physical relationship of the photographic subject in the state where the soft focus filter was arranged on drawing 2 as mentioned above, a soft focus filter, an image formation lens, and an image formation side is shown. In drawing 2 , the light from a photographic subject is influenced of the optical property of a filter by passing a filter. The light which passes transparent Itabe who shows drawing 1 in a filter here contains from a RF to low frequency. On the other hand, the low-pass section passes only low frequency and diffuses light further.
[0007] consequently — for example, although considering the case where a person's face is photoed a certain amount of high frequency component remains (it differs from the picture by focal gap since the profile of a face is carried out somewhat clearly), high frequency components, such as a wrinkling of the skin, cut — having — in addition — and a soft picture which light started on the whole as for a wraparound and the flare can be acquired, and the so-called soft focus effect is acquired
[0008] Such optics Since it is the technology of the common knowledge about digital filter processing, concrete explanation is omitted here.
[0009] In the conventional digital filter processing, the example of a filter for acquiring the effect of soft focus is shown in drawing 3 . First, as filter size, although based also on the picture size of a processing object, th big thing of 30x30 is used, for example. Moreover, about weighting of each element of a filter, it has big weight in a center and has the feature that small weight is in the latus range.
[0010] By performing digital filter processing using such a filter to digital image data, the soft focus effect equivalent to a light filter is acquired.
[0011]

[Problem(s) to be Solved by the Invention] However, there were the following problems in the above-mentioned conventional digital filter processing. For example, if the filter of 30x30 size shown in drawing 3 mentioned above is made into an example, in order to perform filtering, for every picture corresponding to this filter size, it must collapse and addition processing of 30x30=900 time must be performed for integration. Therefore, there was a problem of requiring the huge processing time. Therefore, high-speed processing was demanded from the image processing system which performs this filtering.
[0012] It is made in order that this invention may solve the technical problem mentioned above, and it aims at offering the image processing system which can be performed at high speed, and its method for the digital filter processing which acquires the soft focus effect.
[0013]
[Means for Solving the Problem] As a way stage for attaining the purpose mentioned above, the image processing system concerning this invention is equipped with the following composition.
[0014] That is, it is characterized by to have a picture addition means add an input means to input the 1st image data, a filtering means to perform filtering processing using a predetermined filter to the 1st image data of the above, and to obtain the 2nd image data, and the 1st image data of the above and the 2nd image data of the above, at a predetermined rate, and obtain the 3rd image data, and an output means output the 3rd image data of the above.
[0015] For example, it is characterized by the aforementioned filter being 8x8-pixel size.
[0016] For example, the aforementioned filter is characterized by all coefficients being 1.
[0017] For example, the predetermined rate in the aforementioned picture addition means is characterized by arbitrary things.
[0018] For example, the predetermined rate in the aforementioned picture addition means is characterized by being 0.5 mutually.
[0019] Furthermore, it is characterized by having the display means which can display the above 1st or the 3rd image data.
[0020] Moreover, the image-processing method concerning this invention is equipped with the following processes as a way method for attaining the purpose mentioned above.
[0021] That is, it is characterized by to have the picture addition process of adding the input process which inputs the 1st image data, the filtering process which performs filtering processing using a predetermined filter to the 1st image data of the above, and obtains the 2nd image data, and the 1st image data of the above and the 2nd image data of the above at a predetermined rate, and obtaining the 3rd image data, and the output process which outputs the 3rd image data of the above.
[0022]
[Embodiments of the Invention] Hereafter, 1 operation form concerning this invention is explained in detail with reference to a drawing.
[0023] The outline composition of the image processing system in this operation form is shown in drawing 4 . In drawing 4 , 1 is the picture input section and inputs the image data used as a processing object. For example, you may be the interface device which inputs image data from an external computer, and facsimile apparatus is sufficient. Suppose that it is the scanner which reads a manuscript picture optically in this operation form. 2 is the image-processing section and performs soft focus processing to the picture inputted from the picture input section 1. 3 is the image display section and displays the picture inputted into the image-processing section 2, the picture of the result which performed processing, etc. 4 is the picture output section and outputs the image data of the result processed in the image-processing section 2. For example, you may be an output interface device to an external device, and facsimile apparatus is sufficient. Suppose that it is the printer formed and outputted on a record medium by making the image data after processing into hard copy in this operation form.
[0024] Next, the detailed composition of the image-processing section 2 is shown and explained to drawing 5 . In drawing 5 , 5 is CPU, begins to control the inside of the image-processing section 2, and controls each composition shown by drawing 4 . 6 is the image data accumulation section and is the memory for holding the image data read from the picture input section 1, the image data which it is in the middle of processing, the image data which it is as a result of

processing. 7 is the filtering processing section, performs filtering processing to the input image data held at the image data accumulation section 6, and writes the result in the image data accumulation section 6 again. 8 is a picture adder unit and can add the pixels in the image data currently held at the image data accumulation section 6 at an arbitrary rate.
[0025] Hereafter, filtering in the image processing system of this operation gestalt which consists of the above composition is explained with reference to the flow chart of drawing 6 . Drawing 6 is the flow chart of filtering performed in the image-processing section 2 by setting.
[0026] - Step S1 In Step S1, the image data inputted by the picture input section 1 is first read into the image-processing section 2. The picture input section 1 of this operation form is the scanner of a flat head type. If the picture of a photograph etc. is set to a manuscript base and read is started, the scan of a manuscript will be performed by control of CPU5 and reading of image data will be performed. Image data is saved in the image-processing section 2 to the image data accumulation section 6. In addition, the image data treated in this operation form presupposes that it is the color picture which consists of 8 bits of RGB each. Moreover, since the inputted image data is displayed on the image display section 3, it can check the result of an input of an operator visually.
[0027] - Step S In Step S2, filtering processing is performed to the 2nd order to input image data.
[0028] As the conventional example mentioned above explained, the filter as shown in drawing 3 was conventionally used for soft focus processing. Since this is the filter of big size called 30x30, per pixel collapses it and it needs addition processing of 30x30=900 time in integration. Therefore, the huge operation time was required. Moreover, since weighting factors differed by part for a part for a core, and a periphery, multiplication processing with a weighting factor and a pixel value was needed, and the operation had been complicated. Therefore, there was a fault that the operation time will become [a weighting factor] long compared with an equal filter altogether. By these two causes, the operation time huge as a result was required.
[0029] Therefore, in this operation gestalt, the filter which realizes soft focus processing was shown in drawing 7 . In the filter shown in drawing 7 , filter size is 8x8 and all weighting coefficients are "1." This filter is beforehand held in the filtering processing section 7.
[0030] What is necessary is for per pixel to collapse and just to perform addition processing of 8x8=64 time in integration by using such a filter, with this operation gestalt. Moreover, since all weighting factors are "1", it is not necessary to perform multiplication. According to these two factors, large shortening of the operation time was attained in this operation gestalt.
[0031] In addition, a filtering processing result is stored in the image data accumulation section 6.
[0032] - Perform addition processing of image data in step S3 step S3. Specifically, subject-copy image data and the image data [finishing / filtering] obtained at Step S2 are added at an arbitrary rate.
[0033] Each pixel in image data [finishing / I (x y) and filtering processing of each pixel in subject-copy image data] is set to F (x y) here, and each pixel in the image data finally outputted is set to O (x y). Then, O (x y) is expressed with the following formulas.
[0034]
$O(x\ y) = aI(x\ y) + bF(x\ y)$ — (1)
Here, they are a and b. They are the arbitrary constants which are $0 \leq a$, $b \leq 1$, and $a+b=1$.
[0035] By this processing, in last image data O (x y), the high frequency component of a subject-copy image remains to some extent, and a low-frequency component (portion with little change of brightness) acquires the effect of becoming smooth. That is, a result equivalent to the picture photoed using the optical soft focus filter can be obtained.
[0036] In addition, a=b=0.5 are adopted in this operation form. For this reason, operation of actual (1) formula $O(x\ y) = (I(x\ y) + F(x\ y))/2$ — (2)
** — it ends with a simple operation [like] and improvement in the speed of the further processing can be realized
[0037] In addition, the image data obtained as a result of addition processing is stored in the image data accumulation section 6. Moreover, since this image data is displayed on the image

display section 3, it can check the result of soft focus processing of an operator visually.
[0038] - Output the image data obtained at Step S3 from the picture output section 4 in Step S4 and Step S4. As for the picture output section 4, formation and printing of a picture are performed by control of ** RI and CPU5 with the ink jet printer of a color.
[0039] Soft focus filter processing in this operation gestalt is realized by the processing explained above.
[0040] Even if it performs filtering processing with the filter all whose coefficients according to this operation gestalt it is comparatively small size and are "1" as explained above, the soft focus effect is acquired by adding the image data and subject-copy image data after this filtering at an arbitrary rate after that. Therefore, digital filter processing for acquiring the soft focus effect can be performed at high speed.
[0041] In the 1st operation gestalt whose operation gestalt > **** < others did, although the picture input section 1 explained as a flatbed type scanner, of course, the picture input device using area sensors, such as a drum scanner or a TV camera, may constitute the picture input section 1. Moreover, you may input by reading the picture currently beforehand recorded on magnetic mediums, such as a hard disk, a floppy disk, and a magneto-optic disk.
[0042] Moreover, in the 1st operation gestalt, although the example which performs filtering to the color picture data which consist of 8 bits of RGB each was explained, of course, same processing can be performed also to a monochrome picture.
[0043] Moreover, in the 1st operation gestalt, although size explained the example which uses the filter all whose weighting coefficients are "1" by 8x8, even if all of other filter sizes and weighting coefficients are not "1", the same effect can be acquired.
[0044] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), you may apply it to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.
[0045] Moreover, the purpose of this invention cannot be overemphasized by being attained by supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and reading and performing the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage.
[0046] In this case, the function of the operation form which the program code itself read from the storage mentioned above will be realized, and the storage which memorized the program code will constitute this invention.
[0047] As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, nonvolatile memory card, ROM, etc. can be used, for example.
[0048] Moreover, being contained when the function of the operation form which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation form mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized cannot be overemphasized.
[0049] Furthermore, being contained, when the function of the operation form which performed a part or all of processing that CPU with which the expansion board and expansion unit are equipped is actual, and was mentioned above by the processing is realized based on directions of the program code, after the program code read from the storage is written in the memory with which the expansion unit connected to the expansion board inserted in the computer or the computer is equipped cannot be overemphasized.
[0050]
[Effect of the Invention] Even if it performs filtering processing with the filter all whose coefficients according to this invention it is comparatively small size and are "1" as explained above, the soft focus effect is acquired by adding the image data and subject-copy image data after this filtering at an arbitrary rate after that. Therefore, digital filter processing for acquiring the soft focus effect can be performed at high speed.

[0051]

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the image processing system which performs digital filter processing, and its method, concerning an image processing system and its method.

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EFFECT OF THE INVENTION

[Effect of the Invention] Even if it performs filtering processing with the filter all whose coefficients according to this invention it is comparatively small size and are "1" as explained above, the soft focus effect is acquired by adding the image data and subject-copy image data after this filtering at an arbitrary rate after that. Therefore, digital filter processing for acquiring the soft focus effect can be performed at high speed.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, there were the following problems in the above-mentioned conventional digital filter processing. For example, if the filter of 30x30 size shown in drawing 3 mentioned above is made into an example, in order to perform filtering, for every picture corresponding to this filter size, it must collapse and addition processing of 30x30=900 time must be performed for integration. Therefore, there was a problem of requiring the huge processing time. Therefore, high-speed processing was demanded from the image processing system which performs this filtering.
[0012] It is made in order that this invention may solve the technical problem mentioned above, and it aims at offering the image processing system which can be performed at high speed, and its method for the digital filter processing which acquires the soft focus effect.

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MEANS

[Means for Solving the Problem] As a way stage for attaining the purpose mentioned above, the image processing system concerning this invention is equipped with the following composition.
[0014] That is, it is characterized by to have a picture addition means add an input means to input the 1st image data, a filtering means to perform filtering processing using a predetermined filter to the 1st image data of the above, and to obtain the 2nd image data, and the 1st image data of the above and the 2nd image data of the above, at a predetermined rate, and obtain the 3rd image data, and an output means output the 3rd image data of the above.
[0015] For example, it is characterized by the aforementioned filter being 8x8-pixel size.
[0016] For example, the aforementioned filter is characterized by all coefficients being 1.
[0017] For example, the predetermined rate in the aforementioned picture addition means is characterized by arbitrary things.
[0018] For example, the predetermined rate in the aforementioned picture addition means is characterized by being 0.5 mutually.
[0019] Furthermore, it is characterized by having the display means which can display the above 1st or the 3rd image data.
[0020] Moreover, the image-processing method concerning this invention is equipped with the following processes as a way method for attaining the purpose mentioned above.
[0021] That is, it is characterized by to have the picture addition process of adding the input process which inputs the 1st image data, the filtering process which performs filtering processing using a predetermined filter to the 1st image data of the above, and obtains the 2nd image data, and the 1st image data of the above and the 2nd image data of the above at a predetermined rate, and obtaining the 3rd image data, and the output process which outputs the 3rd image data of the above.
[0022]
[Embodiments of the Invention] Hereafter, 1 operation form concerning this invention is explained in detail with reference to a drawing.
[0023] The outline composition of the image processing system in this operation gestalt is shown in drawing 4 . In drawing 4 , 1 is the picture input section and inputs the image data used as a processing object. For example, you may be the interface device which inputs image data from an external computer, and facsimile apparatus is sufficient. Suppose that it is the scanner which reads a manuscript picture optically in this operation gestalt. 2 is the image-processing section and performs soft focus processing to the picture inputted from the picture input section 1. 3 is the image display section and displays the picture inputted into the image-processing section 2, the picture of the result which performed processing, etc. 4 is the picture output section and outputs the image data of the result processed in the image-processing section 2. For example, you may be an output interface device to an external device, and facsimile apparatus is sufficient. Suppose that it is the printer formed and outputted on a record medium by making the image data after processing into hard copy in this operation gestalt.
[0024] Next, the detailed composition of the image-processing section 2 is shown and explained to drawing 5 . In drawing 5 , 5 is CPU, begins to control the inside of the image-processing section 2, and controls each composition shown by drawing 4 . 6 is the image data accumulation

section and is the memory for holding the image data read from the picture input section 1, the image data which it is in the middle of processing, th image data which it is as a result of processing. 7 is the filtering processing section, performs filtering processing to the input image data held at the image data accumulation section 6, and writes the result in the image data accumulation section 6 again. 8 is a picture adder unit and can add the pixels in the image data currently held at the image data accumulation section 6 at an arbitrary rate.
[0025] Hereafter, filtering in the image processing system of this operation form which consists of the above composition is explained with reference to the flow chart of drawing 6 . Drawing 6 is the flow chart of filtering performed in the image-processing section 2 by setting.
[0026] - Step S1 In Step S1, the image data inputted by the picture input section 1 is first read into the image-processing section 2. The picture input section 1 of this operation form is the scanner of a flat head type. If the picture of a photograph etc. is set to a manuscript base and read is started, the scan of a manuscript will be performed by control of CPU5 and reading of image data will be performed. Image data is saved in the image-processing section 2 to the image data accumulation section 6. In addition, the image data treated in this operation form presupposes that it is the color picture which consists of 8 bits of RGB each. Moreover, since the inputted image data is displayed on the image display section 3, it can check the result of an input of an operator visually.
[0027] - Step S In Step S2, filtering processing is performed to the 2nd order to input image data.
[0028] As the conventional example mentioned above explained, the filter as shown in drawing 3 was conventionally used for soft focus processing. Since this is the filter of big size called 30x30, per pixel collapses it and it needs addition processing of 30x30=900 time in integration. Therefore, the huge operation time was required. Moreover, since weighting factors differed by part for a part for a core, and a periphery, multiplication processing with a weighting factor and a pixel value was needed, and the operation had been complicated. Therefore, there was a fault that the operation time will become [a weighting factor] long compared with an equal filter altogether. By these two causes, the operation time huge as a result was required.
[0029] Therefore, in this operation form, the filter which realizes soft focus processing was shown in drawing 7 . In the filter shown in drawing 7 , filter size is 8x8 and all weighting coefficients are "1." This filter is beforehand held in the filtering processing section 7.
[0030] What is necessary is for per pixel to collapse and just to perform addition processing of 8x8=64 time in integration by using such a filter, with this operation form. Moreover, since all weighting factors are "1", it is not necessary to perform multiplication. According to these two factors, large shortening of the operation time was attained in this operation form.
[0031] In addition, a filtering processing result is stored in the image data accumulation section 6.
[0032] - Perform addition processing of image data in step S3 step S3. Specifically, subject-copy image data and the image data [finishing / filtering] obtained at Step S2 are added at an arbitrary rate.
[0033] Each pixel in image data [finishing / I (x y) and filtering processing of each pixel in subject-copy image data] is set to F (x y) here, and each pixel in the image data finally outputted is set to O (x y). Then, O (x y) is expressed with the following formulas.
[0034]
$O(x\ y) = aI(x\ y) + bF(x\ y)$ — (1)
Here, they are a and b. They are the arbitrary constants which are $0 \leq a, b \leq 1$, and $a+b=1$.
[0035] By this processing, in last image data O (x y), the high frequency component of a subject-copy image remains to some extent, and a low-frequency component (portion with little change of brightness) acquires the effect of becoming smooth. That is, a result equivalent to the picture photoed using the optical soft focus filter can be obtained.
[0036] In addition, a=b=0.5 are adopted in this operation form. For this reason, operation of actual (1) formula $O(x\ y) = (I(x\ y) + F(x\ y))/2$ — (2)
** — it ends with a simple operation [like] and improvement in the speed of the further processing can be realized

[0037] In addition, the image data obtained as a result of addition processing is stored in the image data accumulation section 6. Moreover, since this image data is displayed on the image display section 3, it can check the result of soft focus processing of an operator visually.
[0038] - Output the image data obtained at Step S3 from the picture output section 4 in Step S4 and Step S4. As for the picture output section 4, formation and printing of a picture are performed by control of ** RI and CPU5 with the ink jet printer of a color.
[0039] Soft focus filter processing in this operation form is realized by the processing explained above.
[0040] Even if it performs filtering processing with the filter all whose coefficients according to this operation form it is comparatively small size and are "1" as explained above, the soft focus effect is acquired by adding the image data and subject-copy image data after this filtering at an arbitrary rate after that. Therefore, digital filter processing for acquiring the soft focus effect can be performed at high speed.
[0041] In the 1st operation form whose operation form > **** < others did, although the picture input section 1 explained as a flatbed type scanner, of course, the picture input device using area sensors, such as a drum scanner or a TV camera, may constitute the picture input section 1. Moreover, you may input by reading the picture currently beforehand recorded on magnetic mediums, such as a hard disk, a floppy disk, and a magneto-optic disk.
[0042] Moreover, in the 1st operation form, although the example which performs filtering to the color picture data which consist of 8 bits of RGB each was explained, of course, same processing can be performed also to a monochrome picture.
[0043] Moreover, in the 1st operation form, although size explained the example which uses the filter all whose weighting coefficients are "1" by 8x8, even if all of other filter sizes and weighting coefficients are not "1", the same effect can be acquired.
[0044] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), you may apply it to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.
[0045] Moreover, the purpose of this invention cannot be overemphasized by being attained by supplying the storage which recorded the program code of the software which realizes the function of the operation form mentioned above to a system or equipment, and reading and performing the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage.
[0046] In this case, the function of the operation form which the program code itself read from the storage mentioned above will be realized, and the storage which memorized the program code will constitute this invention.
[0047] As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, nonvolatile memory card, ROM, etc. can be used, for example.
[0048] Moreover, being contained when the function of the operation form which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation form mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized cannot be overemphasized.
[0049] Furthermore, being contained, when the function of the operation form which performed a part or all of processing that CPU with which the expansion board and expansion unit are equipped is actual, and was mentioned above by the processing is realized based on directions of the program code, after the program code read from the storage is written in the memory with which the expansion unit connected to the expansion board inserted in the computer or the computer is equipped cannot be overemphasized.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the structure of the conventional optical soft focus filter.
[Drawing 2] It is the optical system which uses the conventional soft focus filter.
[Drawing 3] It is drawing showing the example of a digital filter of the conventional example.
[Drawing 4] It is the block diagram showing the outline composition of the image processing system of 1 operation form concerning this invention.
[Drawing 5] It is the block diagram showing the detailed composition of the image-processing section in this operation form.
[Drawing 6] It is the flow chart which shows the digital filter processing in this operation form.
[Drawing 7] It is drawing showing the example of a digital filter used with this operation form.
[Description of Notations]
1 Picture Input Section
2 Image-Processing Section
3 Image Display Section
4 Picture Output Section
5 CPU
6 Image Data Accumulation Section
7 Filtering Processing Section
8 Picture Adder Unit
9 Path

[Translation done.]

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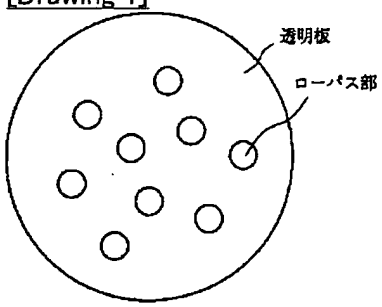
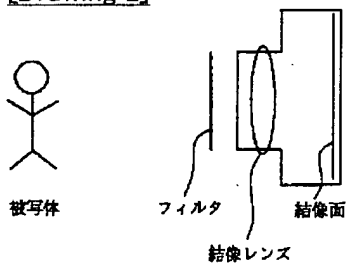
DRAWINGS

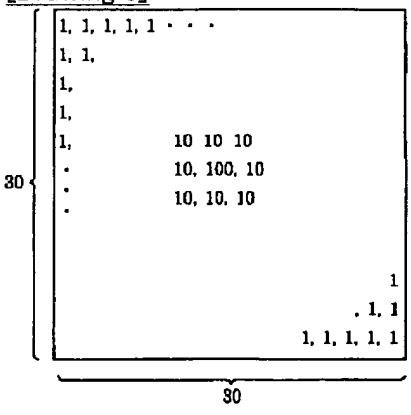
[Drawing 1]



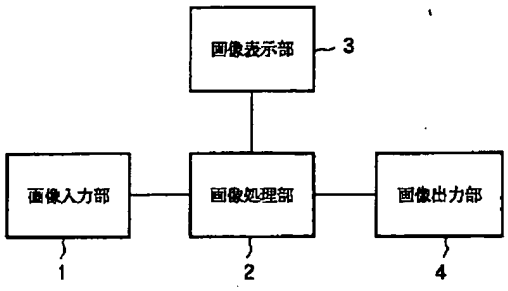
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Drawing 7]

1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
1,	1,	1,	1,	1,	1,	1,	1
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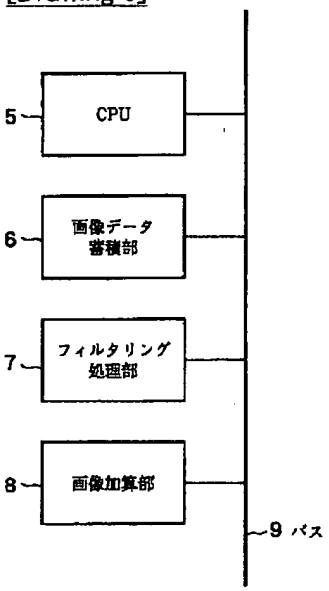
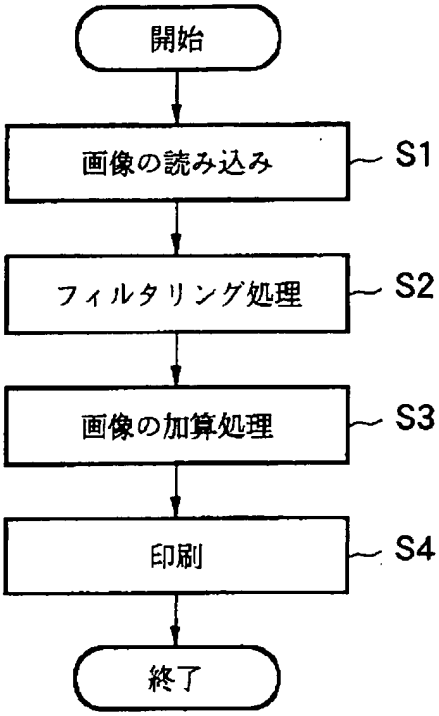
[Drawing 5]



[Drawing 6]



[Translation done.]